

Magnetic degeneracy and hidden metallicity of the spin-density-wave state in ferropnictides

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Abstract

We analyze spin-density-wave (SDW) order in iron-based superconductors and electronic structure in the SDW phase. We consider an itinerant model for Fe pnictides with two hole bands centered at $(0,0)$ and two electron bands centered at $(0,\pi)$ and $(\pi,0)$ in the unfolded Brillouin zone. A SDW order in such a model is generally a combination of two components with momenta $(0,\pi)$ and $(\pi,0)$, both yield (π,π) order in the folded zone. Neutron experiments, however, indicate that only one component is present. We show that $(0,\pi)$ or $(\pi,0)$ order is selected if we assume that only one hole band is involved in the SDW mixing with electron bands. A SDW order in such three-band model is highly degenerate for a perfect nesting and hole-electron interaction only but we show that ellipticity of electron pockets and interactions between electron bands break the degeneracy and favor the desired $(0,\pi)$ or $(\pi,0)$ order. We further show that stripe-ordered system remains a metal for arbitrary coupling. We analyze electronic structure for parameters relevant to the pnictides and argue that the resulting electronic structure is in good agreement with angle-resolved photoemission experiments. We discuss the differences between our model and $J_1 - J_2$ model of localized spins. © 2010 The American Physical Society.

<http://dx.doi.org/10.1103/PhysRevB.81.024511>
